

## COMPUTER COURSES IN HIGHER-EDUCATION: IMPROVING LEARNING BY SCREENCAST TECHNOLOGY

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### ABSTRACT

*The aim of the study was to find out a method designated to improve the learning of computer courses by adding Screencast technology. The intention was to measure the influence of high-quality clips produced by Screencast technology, on the learning process of computer courses. It was required to find out the characteristics (pedagogical and technical) of such high-quality video clips as well as their advantages for improving the learning process in such courses.*

*The research was based on a sample of learners in two computer courses ( $n=30$ ) in higher-education. Both courses have been fully covered by video clips (not exclusively) produced by screencast technology. The learners were asked to answer a questionnaire focused on the characteristics of effective clips as well as the advantages of such clips for their learning.*

*The research results point out that according to learners' views, video clips' effectiveness depends mainly on lecturers' instructional qualifications as well as their capability of technically producing high-quality videos. Such clips covering the whole course curriculum, are advantageous for learning computer courses: the learning process is perceived to be excellent, video clips are better than texts and its substantial flexibility is a great advantage as well. Therefore, there is a significant worthiness to add screencast technology to computer courses provided that the entire course is fully covered with relevant video clips, and they are pedagogically and technically of high-quality. Furthermore, using this kind of technology may be suitable for other kinds of courses, including visual components like formulas, diagrams or tables.*

*Keywords: Screencast, Video Screen Capture, Video Clips, Learning, Computer Courses.*

### INTRODUCTION

#### **General Background**

A screencast is a digital video and audio recording of what occurs on a presenter's computer screen, and it can be used to create sophisticated, information-rich multimedia presentations. In a screencast, the presenter records all the screen activity and images continuously to complete a designated task. Audio can be recorded simultaneously or afterwards in post production along with sound effects and music tracks. Screencasts are effective instructional format that can be used for tutorials, demonstrations, digital storytelling, and narrated presentations. During the video editing process, a variety of media can be imported into a screencast project, such as video clips, photos, music, and animations. Screencasting is a multimedia alternative to

video recording, is easy to use, and helps to fill a need for dynamic, engaging content (Ruffini, 2012).

The term screencast compares with the related term screenshot; whereas screenshot generates a single picture of a computer screen, a screencast is essentially a movie of the changes over time that a user can see on a computer screen, enhanced with audio narration. In classrooms, teachers and students can use this tool to create videos to explain content, vocabulary, etc. Videos can make class time more productive for both teachers and students. Screencasts may increase student engagement and achievement and also provide more time in which students can work collaboratively in groups, so screencasts help them to think through cooperative learning. In addition, videos allow students to move at their own pace since they can pause or review content anytime

and anywhere (Screencast, 2014).

A lot of programmes create screencasts, and they change in features and cost. Tools are divided into two main groups:

1. Free tools: such as Jing, Screenr, Screencast-o-Matic (PC only), CamStudio and Community Clips (PC only).
2. Commercial tools: such as Camtasia Studio, iShowU HD Pro (Mac only), Adobe Captivate, ScreenFlow (Mac only).

For creation of screencasts designating to supplement lessons without limitations, it is recommended to use a programme such as Camtasia Studio, which has a user-friendly interface and functions designed to be easy to use while providing a quality production (Ruffini, 2012). It enables the creation of any type of video (training, demonstrations, presentations, online courses, etc.) with inclusions of screen recordings, audio, voice narration, PowerPoint, Picture-in-Picture and webcam video. Furthermore, it is helpful for editing and enhancing videos with callouts, titles, credits, zooming, panning, quizzes and additional audio tracks. Moreover, it is useful for publishing and sharing the screencast videos in a variety of video formats, including direct upload to the net (Yuen, 2007).

Nowadays, educators in a lot of disciplines are using screencasting for instructional purposes. Instructional screencasts and online video tutorials have been developed to teach a wide variety of topics, such as computer courses (Yuen, 2007), instructional design and technology (Sugar, Brown and Luterbach, 2010), object-oriented programming (Lee, Pradhan, & Dalgarno, 2008), undergraduate student research (Jenkins-Brown, 2008), assistive technologies (Van Laarhoven et al., 2008), mathematical modelling (Ellington & Hardin, 2008), nursing (Phillips & Billings, 2007), and the Dewey Decimal Classification System (Peterson, 2007). The aim of these screencasts and video tutorials is to teach learners about a topic and to demonstrate specific actions associated with the particular content area.

There are definite benefits and advantages in using screencast for instructional purposes. In their learning environments, learners can view a particular screencast at their own convenience and multiple times, if desired. By using a screencast, learners can see how to complete a

particular procedure and can observe what the actual screen looks like in completing the specific operation (Peterson, 2007). Using screencasts can have positive effects on student learning and can be pedagogically equivalent to their face-to-face instruction colleagues (Pang, 2009; Traphagan, Kucsera, & Kishi, 2010). Hartsell and Yuen (2006) observed that online video-based instruction brings courses alive by allowing online learners to use their visual and auditory senses to learn complex concepts and difficult procedures.

The combination of sound and images within a screencast enhances online learners' experiences compared to the more traditional text format and can be a powerful method of communicating content in an online setting. Mayer's (2001) theory of multimedia learning suggests that animated presentations that have a corresponding audio component, essentially moving picture and sound, provide a more effective learning experience than a more traditional alternative (namely, still pictures accompanied by text). It fits the dual coding theory of Paivio (2007), claiming that information processed through discrete input channels, linguistically and non-linguistically based channels, can improve the learning experience.

Theoretically, screencasts may have a positive effect on learning because they provide multiple input channels by presenting an expert performing and describing a task. Wouters, Paas, and van Merriënboer (2008) have observed that the instructional methods of modelling and replacing learning, in which experts perform problem-solving tasks for learners while explaining their actions, are a good fit with teaching task performance. Screencasting technology fits well with this instructional approach in that it presents digital video of the expert's actions for the learner to see while simultaneously presenting the expert's audio commentary on his or her actions. Conversely, Wouters et al. (2008) warn to be careful while designing presentations showing performance of a complex task because of the danger of overloading the limited cognitive capacity of the learner.

Learners within an online learning environment rely heavily on 'learning objects' which are presented to them in various forms. A 'learning object' is any reusable digital resource, which is integrated in a lesson or assemblage of lessons

grouped in units, modules, courses and even programmes. These resources can take the form of an electronic text, a simulation, a website, a graphic image, a movie or any other. They are intended to support learners in technology assisted learning (McGreal, 2004). The idea for providing online learners with such varied resources rests on Mayer's (2001) 'learning-preferences hypothesis', who argues that it is best to present information in many different formats to cater for learning preferences, which may be dependent on learning styles. Clearly, a method that combines both sound and visuals will appeal to a great variety of learning styles than information that is presented through text and pictures only (Gardner, 1983).

Relating to computer courses, Yuen (2007) claims that video has played an important role in teaching and learning. If a picture is worth than a thousand words, then a moving picture is invaluable for explaining and demonstrating the complicated content on today's computers. Pre-recorded videos of computer-based steps have proven to be an effective means of showing how software applications work. Screencast technology is one of the most powerful tools for creating productive training, tutorials, and presentations. The digital video technology and video screen capture software allows teachers to easily create and record original, high-quality pre-recorded software presentations that can be used for in-class demonstrations and run by students for further review at their convenience on the Web. Students can follow the videos and then practise on their own and complete the assignments. They can learn complex computing techniques and tasks via digital videos or access material when they miss a class due to illness or unexpected circumstances. The video screen capture software is a very effective way of delivering software instruction, and it is ideal for student-centred learning and an online learning environment (Yuen, 2007).

Video screen capture allows faculty members to synchronize audio and visual lecture content, so that lessons can be viewed, as well as heard, at a later date. The addition of a graphics component to traditional podcasting provides additional clarity for students who rely on a graphical interface in addition to what is heard via

lecture/discussion (Campbell, Grossman, Kris, Kazer & Rozgonyi, 2010). The use of this technology does not require significant investment in either Information Technology (IT) infrastructure or faculty development. With one PC and a microphone, screen capture is easily done. As an added benefit, faculty who need to travel during the semester can provide lecture content to students while away as well as obtain valuable peer evaluation feedback from colleagues who cannot attend classes due to time conflicts. Furthermore, students can use these lectures for self-learning, re-mediation, or in the event of a missed class in an efficient, cost-effective manner. The exponential growth in the use of smartphones and personal handheld devices means that students can watch these enriched video clips anytime, anywhere (Campbell et al., 2010).

Video screen-capture instructional technology augments a teacher's live lesson into a digital media format. Ensuing multimedia lesson becomes a cognitive tool that supports, guides, and mediates the cognitive processes of learners (Kong, 2011). A teacher's entire multimedia curriculum can be made available to students outside the school as a flipped classroom (studying principles at home via screencast technology following by guided practice in class) model or accessed inside the blended classroom (Smith & Smith, 2012).

The rationale for multimedia instruction that incorporates moving images of an instructor, can be traced back prior to the development of text and language. Man's earliest forms of communication were exhibited in gesture. Gesture theory states that postures and gestures preceded language as a form of communication (Paivio, 2007). Incorporating gestures with auditory narration in a multimedia lesson builds upon the hypothesis that audio and visual information presented together minimizes the overall cognitive load. As students view multimedia instruction, the learner can be signalled by cues toward relevant information, thereby reducing any extraneous load (De Koning, Tabbers, Rikers, & Paas, 2007).

Smith & Smith (2012) found out that students who learned Computer-Aided Design (CAD) by watching video clips based on screencast technology, had significantly higher grades than those who studied the same course using the

traditional textbook instruction. Walker (2010) has reached very similar findings relating to teaching of statistical functions of Excel.

Loch & McLaughlin (2011) claim that most literature on the effectiveness of screencast technology in higher education focuses on student learning and use of the recordings, but not on student engagement and best practice of instructional design. Sugar et al. (2010) describe the "anatomy of a screencast", following analysis of screencasts on how to undertake certain tasks on the computer. The authors found common structural elements and instructional strategies. Heilesen (2010) provides an overview of the literature relating to podcasting and points out that the positive outcomes from the use of screencasts may be caused by the use of the technology, rather than by the technology itself. He argues that techniques shown to improve academic performance such as active learning and revision may be supported by the technology. Screencasts may be designed to allow students to personalise their learning, highlight important information and listen at their own pace (Sutton-Brady, Scott, Taylor, Carabetta and Clark, 2009). Sutton-Brady et al. (2009) also emphasise the need to focus on pedagogical design when producing short screencasts targeting individual topics to distinguish them from a repeat of lecture content. Heilesen (2010) recognises the opportunities available through this technology, as screen casting "has opened up for new ways of integrating classroom teaching and net-based learning on the basis of pedagogical concerns rather than mere administrative convenience".

McCombs & Liu (2007) suggest to record complimentary information rather than replicate existing information, and to add extra visual information to explain the content and to trigger new focus and attention.

### ***Examining Computer Courses Covered by Screencast Technology***

Computer courses require explained demonstrations of complicated routines performed on computers, so that learners would both understand complex ideas as well as practically implement procedures. Examples of such courses might be CAD or statistical functions of Excel mentioned above. Other alternatives for computer courses

may be SPSS (Statistical Package for the Social Sciences), MATLAB (language and interactive environment for numerical computation, visualization, and programming), LMS (Learning Management System), AutoCAD (2D and 3D computer-aided design and drafting) and so on. A recorded video lecture produced by screencast technology can be an asynchronous replacement or supplement for a live lecture. It might be especially applicable to computer courses in which all actions performed on a computer screen are recorded and explained. Such a recorded lesson can be watched several times, entirely or partially without any limitations.

The study examined the characteristics of effective video clips produced by screencast technology as well as the advantages of such clips for learning of computer courses. Two courses were examined and all topics were fully covered (not exclusively) by dozens of clips.

The following two courses were examined:

- PSPP (Statistical software which is equivalent to SPSS): A one-year course given to third-year students in a teacher-training college. The course included the following main topics: introduction, data editor, principles of descriptive statistics, syntax, cases' selection, means, computerised variables, sorting files, data control, T-test, Analysis of Variance (ANOVA), crosstabs, chi square, reliability (Cronbach's alpha), item analysis and factor analysis. All topics were fully covered (in addition to texts and face to face lectures) by 36 high-definition (HD) clips, prepared by video screen capture technology. The total length of all the clips together was 226 minutes (3 hours and 46 minutes).
- Management of Online Courses: A two-year course delivered to lecturers teaching in ten teacher training colleges. The course included the following topics: Learning Management System (LMS), Computer Assisted Assessment (CAA), video, audio, text, control of a remote computer, online synchronous learning, website development and screenshots. All topics were fully covered by 50 HD clips (as well as by texts and lectures), prepared by screencast technology. The total length of all the clips together was 446 minutes (7

hours and 26 minutes).

## Method

The study examined learners' perceptions toward combining of instructional screencast video clips in two computer courses. The courses were delivered in two institutions of Higher Education: The Neri Bloomfield School of Design and Education in Haifa and The Mofet Institute in Tel-Aviv. Both courses have been taught by the same lecturer using equivalent tools, pedagogy and standards.

## Research Questions

The research questions intended to measure the influence of using high-quality clips produced by screencast technology, on the learning process of computer courses. The following research questions were worded:

1. *What are the characteristics of high-quality (pedagogical and technical) video clips produced by screencast technology relating to learning of computer courses?*
2. *What are the advantages of such clips for improving the learning process in that kind of courses?*

## Population and Sample

### Population

The population addressed through the study included all learners studying computer courses in Israeli teacher-training colleges (25 colleges overall).

### Sample

30 learners overall - 14 students in a one-year PSPP course (statistical software equivalent to SPSS) and 16 learners participated in a two-year course focused on management of online courses.

Respondents were asked to answer a questionnaire at the end of each course (2013-2014), concerning their perceptions toward the research questions mentioned above.

The questionnaire was anonymous, and the rate of response was 93.75% (30 out of 32).

## Tools

In order to answer the research questions, a questionnaire, including 21 closed statements was prepared. The questionnaire was given to learners in both colleges. For

each question, the respondents were requested to mention their views on the following Likert five-point scale:

- 1 Strongly disagree.
- 2 Mostly disagree.
- 3 Moderately agree
- 4 Mostly agree.
- 5 Strongly agree.

In addition to these statements, the questionnaire included an open-ended question as well. It was designed to accomplish the main data gathered by the quantitative part of the questionnaire, as follows:

*Mention additional comments concerning a combination of screencast video clips in computer courses. Among others, you may consider the following issues: advantages/disadvantages of instructional video clips based on screencast technology for learning process (including comparison to other ways of learning) and characteristics of effective clips.*

## Data Analysis

In order to examine the validity of the questionnaire, the factors' reliability was calculated using Cronbach's alpha. Based on the reliability found, the following six factors shown in Table 1 were divided into three groups, as follows:

### 1. Video Quality of the Examined Courses:

Degree of clarity of the lecturer's explanations and voice, lecture's pace, degree of cover of the curriculum, quality of presentation and illustration of tasks to be performed on the computer.

### 2. Characteristics of Effective Clips:

- Importance of pedagogic characteristics: lecturer's ability to explain and speak clearly, clip's length, teaching at a moderate pace and the extent by which the curriculum is covered.
- Importance of technical characteristics: videos' resolution, using a zoom, downloading options, and watching in variety of tools.

### 3. Advantages of Video Clips:

- Video clips' flexibility: Flexibility of watching on appropriate time and opportunities to watch



repeatedly.

- Effectiveness for learning: The extent by which clips are helpful for learning, contribution to dealing with the curriculum and following and assimilating the course material.
- Advantages in comparison to texts: The extent by which video clips explain and illustrate performing on the computer, in comparison to texts and screen shots.

For each factor, there was found a high value of reliability (ranges from 0.568 to 0.707). Every factor (having more than one item) has been determined by calculating the mean value of the items composing it.

For each factor, a mean score was calculated (including standard deviation). The following statistical tests have been undertaken as well ( $\alpha < 0.05$ ):

- Independent Samples T-test: In order to check significant differences of factors' means between the two courses (two colleges).
- Paired Samples T-test: It was conducted for checking significant differences between pairs of factors.

## Results

There was no significant difference between the two

courses concerning the mean scores of all factors examined (t-test,  $\alpha < 0.05$ ). It means that there was a replication of the results found in the first course also in the second one. It strengthens the findings and gives them more validity. Consequently, Table 2 presents the mean scores of both courses together and the independent samples t-test, showing that the differences between the two courses are not significant.

Table 2 presents the following results:

- The quality of all video clips in both courses was extremely high, and the score was very close to the maximum value possible (4.79). The meaning of this finding is that respondents in both courses rate the lecturer's explanations as truly clear and suitable as well as claiming that the pace is appropriate. Furthermore, they argue that the course video package is comprehensive, namely, it fully covers the whole course curriculum and well presents and illustrates all tasks they have to perform on the computer. This finding is tremendously important for dealing with all the other factors, relating to the research questions. It means that all responds related to the research question are based on high-quality experiences of

Factors	Questionnaire's questions
Clips' quality Alpha=0.707	Lecturer's explanations were clear. Lecturer's voice was clear. Lecturer's explanations were made at a moderate pace. The course curriculum was fully covered by video clips. Videos well presented and illustrated all tasks I had to perform on the computer.
Importance of pedagogic characteristics for effective clips Alpha=0.673	Clips' effectiveness depends on a lecturer's ability to explain clearly. I prefer that each clip would be short and address not too many topics. Clips' effectiveness depends on a lecturer's ability to speak clearly. Clips' effectiveness depends on a lecturer's ability to talk at a moderate pace. Video clips should fully cover the whole curriculum.
Importance of Technical characteristics of effective clips Alpha=0.568	Good training videos should be of high quality (HD). Using the zoom (focus on certain areas on the computer screen) helps me to learn. The option to download video clips is important for me. The option to watch videos in a variety of tools (such as tablet, smartphone, MP4 Player, etc.) is important for me.
Video clips' flexibility Alpha=0.641	It is very advantageous to watch video clips many times as I wish without limitation. It is very helpful to watch video clips on times I choose.
Clips' effectiveness for learning Alpha=0.631	The video clips were helpful for my learning. The clips had significant contribution to my ability to deal with the curriculum. The video clips allow me to thoroughly follow any course material. Videos allow me to optimally assimilate the material.
Clips' advantage in comparison to texts	The advantage of video clips is that they explain and illustrate performing of activities in a clear and efficient way, better than a combination of text and screen shots.

Table 1. Factors and reliability.

Factors' groups	Factors	N	Mean	Std.Deviation	Independent Samples T-Test
Courses' video quality	Clips' quality	30	4.79	.319	$t_{(28)} = -.015, p = .988$
Effective clips' Characteristics (first research question)	Importance of pedagogic characteristics for effective clips	30	4.42	.459	$t_{(28)} = .293, p = .772$
	Importance of technical characteristics for effective clips	30	4.19	.593	$t_{(28)} = -.881, p = .386$
Video clips' advantages (second research question)	Video clips flexibility	30	4.90	.305	$t_{(28)} = .473, p = .640$
	Video clips effectiveness for learning	30	4.68	.400	$t_{(28)} = 2.351, p = .058$
	Video clips advantages in comparison to texts	29	4.52	.688	$t_{(28)} = 1.553, p = .134$

Table 2. Mean Factors for both institutions together (descending means in each factors' group)

video packages.

- Relating to the first research question (dealing with effective clips' characteristics), learners rate the pedagogic characteristics as very important for the video clips' effectiveness of learning (4.42). It means that in order to produce effective clips, a lecturer should explain clearly and in a moderate pace and the clips should be short and cover the whole curriculum. Concerning the technical characteristics, they are perceived to be very important as well (4.19), namely, clips should have HD resolution, zoom for focusing on relevant screen areas, and they should be independent of specific hardware or operating system. Comparing those two factors reveals that there is a significant difference between them ( $t_{(29)} = 2.23, p = .034$ ). It means that although both factors are highly rated, the pedagogic characteristics are perceived to be more important (4.42) than the technical features (4.19).
- Concerning the second research question (dealing with video clips' advantages), respondents rate their flexibility as the greatest advantage (4.90). There is a significant difference between this factor (flexibility-4.90) and the other two ( $t_{(29)} = -2.955, p = .006, t_{(28)} = -2.560, p = .016$ ).

Moreover, such high-quality video clips are perceived to be very effective for the whole learning process of computer courses (4.68). This is reflected by being very helpful for studying and dealing with the curriculum thoroughly, as well as optimally assimilating the material. Furthermore, such video clips are perceived to be superior compared to texts (4.52). Their major advantage is the

capability to explain and illustrate performing of activities in a clear and efficient way, better than a combination of text and screen-shots.

Comparing those two factors (clips' effectiveness for learning-4.68 and their advantages compared to text-4.52), reveals that there is no significant difference between them ( $t_{(28)} = 1.022, p = .315$ ).

The meaning of these findings is that based on two computer courses, which have comprehensively been covered by video clips, effective clips that fully cover computer courses, have the following attributes:

- In order to be effective, video clips should be of very high-quality, both pedagogically and technically.
- Effective clips have significant advantages such as substantial flexibility as well as supporting a perfect learning process which cannot be achieved by texts and screen-shots only.

## Respondents' Quotes

The open-ended questions strengthen the closed items as shown by the following examples:

- *The First Course (PSPP)*

*"This kind of learning is very efficient and effective for me."*

*"Thank you very much for the hard work required to prepare so many video clips covering the whole course. It has been tremendously helpful."*

*"I should mention that the video clips are made in a very meticulous and understandable way."*

*"Video clips have a great advantage, and they are very helpful, especially during the exams. They give me the feeling that I am in class while I stay at home. It helps me a lot to understand and succeed. Nevertheless, I would not*

*give up the face to face lectures. They are also very helpful for communicating with the lecturer in real time. The clips are also useful if I forgot or did not understand something."*

*"It is very easy to realize the clips' advantages following the excellent grade I have got in semester A. While studying for the exam I focused mainly on the clips. In my view, the explanations cover the whole curriculum, and they are very clear. Therefore, I think that the course could have been fully remote."*

*"I succeed in this course just because of the video clips. The time and length of the lesson prevented me to concentrate and understand what happens in class."*

- *The Second Course (Management of Online Courses)*

*"Effective learning process is based on a combination of video clips, texts and the lecturer's accessibility for technical support. The videos are great for practice, repetition and to refresh the material. They should not be a replacement to a face to face lesson. It is very important they would be focused, short and clear. Thank you very much for the efforts invested in providing access to the materials."*

*"The clips accompanying the course enabled me to practise outside the classroom with very clear guidance. This fact is absolutely helpful. It is much better for me than reading textual descriptions. That is definitely a perfect tool for learning computer courses. The ability to watch and exercise repeatedly, makes this kind of studying convenient and encouraging."*

*"Video clips substantially enrich my learning methods, although I usually read the texts and try to implement it myself. Only later, I used to watch a video clip in order to assimilate the knowledge. In fact, the video adds another layer to my 'conservative' learning process. When something is not clear concerning the written explanations, I do not hesitate to turn to a video clip and get full support."*

*"Characteristics of effective videos: Comprehensible explanations of the instructor, clear and calm voice and relevant zooming. In my view, there is no need to see the lecturer - it can be remained to live meetings."*

*"Video clips, especially when they are short and focused*

*on a single component, can be a terrific tool. Nevertheless, they cannot be a full replacement for a live meeting. Without a mediation of a lecturer located in the background, videos are about to lose their effectiveness."*

The quotes mentioned above stress the great effectiveness and efficiency of videos for learning of computer courses. The clips are not necessarily a replacement of a live lecture but rather an excellent supplement assisting learners to study topics they did not fully understand or missed during the semester. In order to be really effective, videos should be focused on specific issues, short, clear and have a full coverage of the course.

### Conclusion

In higher-education, there are lots of computer courses. Learning such courses is usually quite difficult because of the necessity to understand complex principles as well as practically implement complicated routines. Creating a course that comprehensively supports the acquisition of such knowledge, is not straightforward. The study examined a unique supplement to computer courses, namely, video clips produced by screencast technology. Based on the international literature, there is clear evidence to general advantages of using such means for student learning as a replacement to other ways of studying (Campbell et al., 2010; de Koning et al., 2007; Gardner, 1983; Mayer, 2001; Smith & Smith, 2012; Walker, 2010). Nevertheless, it was not quite obvious what ought to be the characteristics of effective clips based on that technology, and if they can be useful as complementary means rather than exclusive ways of learning. The new study reveals that effective video clips should be of high-quality, both technically and pedagogically.

Technical characteristics are HD resolution, clear sound recording or zooming where necessary (for highlighting specific areas on the screen). In order to reach high-quality, it is necessary to use professional tools such as Camtasia Studio or a combination of free programmes like Microsoft Community Clips and Moviemaker.

Pedagogic characteristics are about to be the following:

- Comprehensive coverage: All course contents should be fully covered (not exclusively) by video clips based on screencast technology. It contains the whole



curriculum, including theory and all kinds of exercises. This coverage is not exclusive, namely, all topics are about to be covered by additional relevant ways of learning such as texts, live lectures, tutoring, etc. The great advantage of combining learning methods is that students can use multiple ways fitting their learning styles and preferences. The study's findings show that students prefer multiple ways of learning enabling them to use the right mean at the right time or a combination of some. For example, students do not necessarily prefer video clips as a replacement to live lectures. They perceive screencasts as very efficient and effective for learning but lots of them prefer to combine videos with live lectures and comprehensive texts.

- Lecturer self-production: All clips should be produced by the course lecturers in order to exactly fit its curriculum and level of difficulty (as has been undertaken in both courses examined). Cases in which clips are produced via outsourcing are about to be unacceptable because they are expected to only partially suit the course demands.
- Short length: Each video clip is about to be relatively short, including not too many topics for enabling students to directly and rapidly find each subject and easily transfer from one issue to another.
- Accuracy and correctness of all course contents: All videos examined during the research have been tested for ensuring a high level of accuracy. In order to do so, each clip should be checked and rechecked by lecturers in order to find defects. Following such a control process, it is remarkably important to fix any inaccuracies, mistakes or faults, which might hurt the learners' process of studying. Repairing such shortcomings can be undertaken by editing the video clip if possible or re-recording it, while editing is impractical.
- Clear and understandable speaking: Lecturers should speak clearly and loudly while recording themselves, so that students would be able to understand well what is said.

Moreover, the study points out that screencast technology,

if used for producing high-quality clips (technically and pedagogically), has the following significant advantages:

- Effective learning: Adding of videos to computer courses has a significant contribution to the effectiveness of the whole learning process, namely, fully understand and assimilate the material, cover the entire curriculum, accomplish gaps if exist and continuously follow all routines and principles being taught.
- Superiority in comparison to texts: The research gives evidence to the hypothesis that effective videos are better means compared to texts and screen-shots. The main reason for this advantage is that clips are perfect means for explaining and illustrating the performance of complex activities undertaken on a computer. It is done clearly and effectively, being an excellent clarified demonstration to what is required to be implemented. Such a presentation stimulates two senses, hearing and vision, as well as demonstrating occurrences, which are identical to what happens in reality. In that sense, clips are better than written material but nevertheless, they are not necessarily an exclusive replacement to texts.
- Flexibility: This characteristic is significant, especially in comparison to live lectures. Although clips are not always a replacement to lectures, they are very helpful because they overcome the limitations of time and place. Students can learn when, where and how many times they wish. They can repeat a lesson unlimited times, until they fulfil the learning process, no matter if they really attended the class.

It should be stressed that in order to practically deliver computer courses, which are fully covered by video clips, it is required to undertake a great deal of preparations. It is not only a matter of the work quantity but also its quality, namely, all final clips must be high-quality, both pedagogically and technically, according to the characteristics mentioned above.

The study examined 30 learners who participated in two courses. The significant quantitative findings which repeated in two institutions show that in order to be really effective, video clips should have specific attributes. If such

efficacious clips are produced, they are about to have an important contribution to the learning process of computer courses. The qualitative data gathered (via the open-ended questions) strengthens the quantitative part and gives it more validity. Although the study has been focused on computer courses only, its findings are expected to be applicable to other kinds of courses in higher-education as well. The findings can be relevant to courses, including visual components, such as formulas, graphs, diagrams, tables or pictures combined with listening to synchronized explanations.

## Recommendation

Following, the major contribution of adding screencast technology to computer courses, it is recommended to adopt such technology in Universities and Colleges, provided that all produced clips are high-quality and comprehensively cover the course curriculum. In order to practically do so, it is required that institutes of higher-education would create and deliver training programmes based on the conclusions mentioned above. The expected consequences are that faculty members would be familiar with screencasting principles, practices and pedagogics so they would be able to produce high-quality instructional clips. The study points out that video clips should not necessarily be a replacement of other ways of learning but they can often be complementary means. Therefore, in order to effectively combine such clips with other relevant methods, training should include main principles of TMOC (Training to Management of Online Courses) as well (Ghilay & Ghilay, 2014). Consequently, lecturers would be able to create, develop and deliver courses combining video, text, hypertext and CAA (Computer Assisted Assessment) based on a Learning Management System.

Such a strategy is expected to be effective concerning computer courses, in particular, but it can even be suitable to other kinds of courses such as economics, maths, engineering, statistics, languages and so on. A change like that, might significantly improve the learning processes in institutions of higher-education worldwide.

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